

METHOD, SYSTEM, AND PROGRAM FOR TRANSFORMING FILES FROM A  
SOURCE FILE FORMAT TO A DESTINATION FILE FORMAT

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

[0001] The present invention relates to a method, system, and program for transforming files from a source file format to a destination file format.

2. Description of the Related Art

10 [0002] Oftentimes, computer users will want to transform a data file in one format to a another format. This operation may be performed by calling an application program utilizing the source format and using the application program to transform the file to a destination format. For instance, many wordprocessor, spreadsheet, database, and other types of programs use a proprietary file format for their files. Such applications also  
15 allow the user to transform a file in the application's proprietary file format to the proprietary format used in a competitor's application. For instance, both Corel WordPerfect and Microsoft Word\*\* allow users to transform files in their proprietary file formats to the file format used by the competing product. Such application programs typically provide access to the file format transformation operation through the "Save As"  
20 item on the file menu item.

[0003] Notwithstanding such techniques for transforming files, there is a need in the art to provide tools to improve the ease by which users can transform files to different file formats.

25 SUMMARY OF THE PREFERRED EMBODIMENTS

[0004] Provided is a method, system, and program for transforming files from a source file format to a destination file format. A data structure is generated in a computer readable medium indicating available transforms from a plurality of source file formats to at least one destination file format. A graphical representation of available transforms

from the source file formats to the at least one destination file format is generated based on the available transforms indicated in the data structure. User input is received indicating a selected source file having a source file format and a selected destination file having a selected destination file format, wherein the data structure indicates one  
5 available transform to transform the selected source file format to the selected destination file format. The selected source file in the source file format is transformed to the selected destination file in the destination file format.

[0005] In further implementations, generating the graphical representation further comprises generating graphical representations of each file format indicated as one source  
10 or destination file format in the data structure and generating a graphical association for each source file format and destination file format pair for which there is one available transform.

[0006] Still further, a graphical representation of a transformation operation may be generated to be displayed between a graphical representation of the selected source file  
15 format and a graphical representation of the selected destination file format.

[0007] The described implementations provide an improved technique for providing information to users on available file format transform operations that utilizes graphical representations of the transforms that may be performed.

20 BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

FIG. 1 illustrates a computing environment in which aspects of the invention are implemented;

25 FIG. 2 illustrates a data structure providing information on available transforms for transforming files in a source file format to a destination file format in accordance with implementations of the invention;

FIG. 3 illustrates a graphical representation of a selected transform to perform from a selected source file format to a selected destination file format in accordance with implementations of the invention;

FIG. 4 illustrates a graphical representation on available transforms for transforming source file formats to destination file formats in accordance with implementations of the invention;

FIG. 5 illustrates logic to add a new transform to the available transforms for transforming source file formats to destination file formats in accordance with implementations of the invention;

FIG. 6 illustrates logic to generate a graphical representation of all available transforms from source file formats to destination file formats in accordance with implementations of the invention;

FIG. 7 illustrates logic to transform a user selected source file format to a user selected destination file format in accordance with implementations of the invention; and

FIG. 8 illustrates a graphical representation of a selected transform to perform including a graphical representation of a progress bar indicating a percentage of the transform operation that has completed in accordance with implementations of the invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] In the following description, reference is made to the accompanying drawings which form a part hereof, and which illustrate several embodiments of the present invention. It is understood that other embodiments may be utilized and structural and operational changes may be made without departing from the scope of the present invention.

[0010] FIG. 1 illustrates a computing environment in which aspects of the invention are implemented. A computer system 2, which may comprise any computing device known in the art (e.g., a desktop, workstation, laptop, personal digital assistant (PDA), mainframe, server, telephone device, etc), having a processor, memory, storage, and

operating system (not shown), includes a plurality of application programs 4a, b...n, such as word processing programs, spreadsheet programs, database programs, software development tools, etc. A transform tool 6 is a program that enables users to transform files in one format to another format, such as from one format used by one application program 4a, b...n to a format used by another application program 4a, b...n. To provide users information on the transforms available for different file formats, the transform tool 6 generates a transform table 8 that indicates the transform operations that may be performed by transformation applications 12a, b...n. Each transformation application 12a, b...n includes executable code to transform files in one or more source formats to one or more other destination formats.

[0011] The computer system 2 further includes an input device 14, such as one or more of a mouse, keyboard, microphone and voice translator, pen stylus, touch sensitive display monitor, etc. and a display device 16, such as a computer monitor.

[0012] FIG. 2 illustrates an example of the  $n \times n$  transform table 8 having one row and one column for each format for which a transformation is provided. An empty cell in the table 8 indicates that there is no transform application 12a, b...n available to perform the transformation from the source file format of the row including the cell to the destination file format of the column including the cell. If there is a transform application 12a, b...n available, then the file path and name of the executable transform application 12a, b...n is included in the cell for the transformation from the "From" file format (row) to the "To" file format (column). For instance, the application program 12a, b...n identified in cell ( $i$ ,  $j$ ) would transform the source file format of row  $i$  to the destination file format of column  $j$ .

[0013] FIG. 3 illustrates an example of a graphical user interface (GUI) 50 used to enable a user to select a transformation to perform on a selected source file in one source file format to a selected destination file having the same or equivalent data in a different destination file format. The user may use an input device 14 (FIG. 1), such as a mouse, pen stylus, etc., to select a source file format by selecting a graphical representation of one displayed file format 52a, b, c, d, e, f, g, h on a displayed format dial 54. The

graphical representation of a file format may comprise an icon typically used to represent the file format and a name of the file format. Alternative graphical representations may also be used to represent the file formats in the display. For instance, the user may select the source file format 52a...h by clicking a button on the mouse, e.g., the left button, 5 while the mouse pointer is positioned over the selected displayed file format icon 52a...h. Similarly, the user may select the destination file format by clicking another button on the mouse input device, e.g., the right button, while the mouse pointer is positioned over the selected displayed file format icon 52a...h. If the user attempted to select a source and destination file for which there was no available transform application 12a, b...n to 10 perform the file transformation, then the transform tool 6 could display a message or other alert that such a source or destination file format cannot be selected for transformation.

[0014] Additionally, upon selecting a source file format, the transform tool 8 may then display those file formats 52a...h for which there is no available transform application 15 12a....n from the selected source file format as "greyed-out" and unselectable to indicate that such "greyed-out" formats cannot be selected as a destination format for the already selected source file. In such implementations, the user would be unable to select the "greyed-out" file format as the destination file format.

[0015] The GUI 50 of FIG. 3 further displays a graphical representation 56 of the 20 transformation to perform in the form of an arrow extending from the user selected source file format 52f to the user selected destination file format 52a. Additionally, other types of graphical representations may be used to illustrate the transform operation that will be performed

[0016] After the user selects the source and destination file formats from the graphical 25 representations 52a, b...h on the displayed format dial 54, the user may then select specific files in the selected file formats to transform by using the input device 14 to enter the source and destination file names in the source and file entry boxes 58 and 60, respectively, or by using the browse buttons 62 and 64 to invoke a file navigator to navigate a file directory to enable selection of the source and destination files through a

navigation window (not shown). If the navigation window is used, then in displaying files to select for the source and destination entry fields 58 and 60, the transform tool 6 may only display files having types of the selected source and destination file formats, respectively.

- 5   **[0017]** Selection of the finish button 66 would perform the selected transformation, as shown in the dial, from a selected source file 58 to the selected destination file 60. For certain transformation types, the user may select various attributes for the transformation. For instance, in transforming a text document or image built using a design program to another format for the text or image, e.g., a Joint Photographic Experts Group
- 10   (JPEG) file, Adobe Acrobat Portable Document Format (PDF) file\*\*, a Graphics Interchange Format (GIF) file, etc., the user may select certain settings for the transformation, such as the quality of the resulting image, finishing, resolution, compression format, etc. If attributes are available for user selection, then a Next button
- 15   68 is enabled to display a further GUI panel in which the user may select various attributes of the transformation. Another example of where attributes may be selected is a transformation from one program format, such as a model file (e.g., a file in the Unified Modeling Language), to another program format, such as the program code implementing the model, e.g., Java. For instance, the user may define or specify mappings of classes in the model file to the source code to utilize when performing the transformation. If there
- 20   are multiple types of attributes to set for the transformation, then multiple entry panels may be provided.

**[0018]** Selection of the view allowable transformations button 70 would generate in the format dial 54 a graphical representation of all possible transformations that may be performed by the transform applications 12a, b...n between the different file formats.

- 25   FIG. 4 illustrates an example of the GUI 80 displayed upon selection of the view allowable transformations button 70. As shown in FIG. 4, the format dial 54 now displays lines illustrating the possible transformations. A one-way arrow, e.g., arrow 82, indicates that a transformation can occur from the file format at the end of the line opposite the arrow (e.g., file format B) to the file format at the end of the line with the

arrow (e.g., file format D). A two way arrow, e.g., arrow 84, indicates that the transformation can occur both ways between the two file formats (e.g., transformation either way from file format A to file format D). If there is no line connecting two file formats, e.g., file formats A and H, then no transformation is available to transform a file  
5 between those two formats.

[0019] The above described graphical user interface provides an integrated tool that enables a user to observe all available transformations that are possible and select files to transform. FIG. 5 illustrates logic implemented in the transformation tool 6 to add a transform application 12a, b...n to the transformations that can be performed by the tool 6.  
10 Control begins at block 100 with the transform tool 6 receiving a transform application 12a, b...n to add to the available transformations. The transform tool 6 determines (at block 102) the transforms performed by the added transform application 12a, b...n. Such information may be maintained in metadata included with the added transform application. A loop is then performed from blocks 104 through 126 for each possible  
15 source (S) file format to destination (D) file format transform performed by the added transform application 12a, b...n. At block 106, the transform tool 6 determines whether there is both a row for file format S and a column for file format (D) in the transform table 8 with a file path entry, i.e., the transformation from the source (S) to the destination (D) file format the added transform application performs is already performed by the  
20 transform tool 6. If the transformation from the source (S) to destination (D) file formats is already handled by one of the current transform applications 12a, b...n, then the transform tool 6 prompts (at block 108) the user to select whether to use the added transform application 12a, b...n or to continue using the currently used transform application 12a, b...n. If (at block 110) the user selected to use the new transform  
25 application for the transformation from the source (S) file format to destination (D) file format being considered, then the entry (S, D) in the transform table 8 is updated with the file path and name of the added transform application 12a, b...n, whereby the new added transform application 12a, b...n will be available to the transform tool 6 to handle transformations from file format S to file format D.

[0020] If (at blocks 108 and 120) there is neither a row nor column in the transform table 8 for the source (S) and destination (D) file formats being considered, respectively, then the transform tool 6 adds (at block 122) a row and column to the transform table 8 for the source (S) and destination (D) file formats, respectively, and then updates (at  
5 block 126) the new entry (S, D) in the table 8 with the file path and name of the added transform application 12a, b...n. If there is one of a row in the transform table for file format S or a column for file format D (from the no branch of block 120), then the transform tool 6 adds (at block 126) one row and column for file format S if there is no such row or adds one row and column for file format D if there is no such column and  
10 then proceeds to block 124 to update the new entry (S, D) with the file path and name of the added transform application 12a, b...n.

[0021] With the logic of FIG. 5, the transform tool 6 is able to dynamically add transform applications 12a, b...n to expand the file format transform capabilities of the tool 6. If a transform application 12a, b...n is removed, then the transform table 8 would  
15 be updated to remove the entries in the transform table 8 that reference the removed transform application 12a, b...n so that the transform tool 6 will not attempt to invoke the removed transform application 12a, b...n to handle the transformation. After removing one transform application 12a, b...n, the transform tool 6 may determine whether another transform application 12a, b...n can handle the transforms handled by the removed  
20 transform application and, if so, update the transform table 8 to include a reference to the remaining transform application 12a, b...n capable of handling the transformation previously performed by the removed transform application 12a, b...n

[0022] FIG. 6 illustrates logic implemented in the transform tool 6 to process a request (at block 150) from the user to view all allowable transformations. The user may make  
25 such a request by selecting the view allowable transformations button 70 (FIGs. 3 and 4) or some other input selection. The transform tool 6 performs a loop at blocks 152 through 164 for each row  $i$  in the transform table from  $i$  equals 1 to  $n$ , where the transform table 8 is an  $n \times n$  matrix. An inner loop is then performed for each row  $i$  from blocks 154 through 162 for each column  $j$ , for  $j$  equals  $(i + 1)$  through  $n$ . Within the inner



loop, if (at block 156) there is a file path included in both the entry (*i, j*) and entry (*j, i*), indicating that transform applications 12a, b...n are available to transform both ways from file format *i* to file format *j*, then the transform tool 6 draws in the window 80 (FIG. 4) a double sided arrow between the graphical representations of file format *i* and *j*, indicating that files can be transformed both ways between the formats *i* and *j*. At block 160, if there is a file path in entry (*i, j*), then a single sided arrow is drawn from icon *i* to icon *j* or if there is a file path in entry (*j, i*), then a single sided arrow is drawn from icon *j* to icon *i*. If there is no transform application 12a, b...n available for performing a transform either way from file format *i* to file format *j*, then no arrow is drawn there to indicate no available transform between the two file formats.

[0023] FIG. 7 illustrates logic implemented in the transform tool 6 to process user selections of file formats in the windows 50 displayed in FIGs. 3 and 4. At block 200, the transform tool 6 receives user selection of a source file format. This selection may be made using an input device 14 to select one of the displayed graphical representations of the file formats 52a, b...h on the format dial 54 or through entry of a file name in the source file entry field 58 (FIG. 3 and 4), wherein the source file format comprises the file format of the entered file. If (at block 202) there is not a row in the transform table 8 for the selected source file format having a non-empty cell, then the transform tool 6 alerts (at block 204) the user that the selected source file type cannot be transformed to another file format, i.e., there is no transform application 12a, b...n available to transform from the selected source file format to another file format. Otherwise, if there is a row with a non-empty cell in the transform table 8 for the selected source file format, then the transform tool 6 waits (at block 206) to receive user selection for a destination file format on the format dial 54 or through entry of a file in the file entry field 60 (FIGs. 3 and 4), wherein the file format of the entered destination file comprises the selected destination file format. If (at block 208) there is a non-empty cell at entry S, D, i.e., the source (S) file format row and the destination (D) file format column, then the transform tool 6 calls (at block 212) the transform application 12a, b...n identified at the file path and name in entry (S, D) in the transform table 8, with the source and destination files to transform as

parameters, to transform the user selected source file in the source file format to the user selected destination file in the destination file format. Otherwise, if the entry (S, D) in the transform table 8 is empty, then the transform tool 6 notifies the user that the selected destination file format is not available for transformation, i.e., there is no transform application 12a, b...n available to perform the transformation from the selected source file format to the selected destination file format. As discussed, in certain implementations, the transform tool 6 will not allow the user to select a destination file format for which there is no transform from the selected source file format to destination file format. As discussed, those file formats for which there is no available transform application 12a, b...n from the source file format are displayed as unselectable. e.g., greyed-out.

[0024] FIG. 8 illustrates a further implementation of the GUI shown in FIGs. 3 and 4, where the transform tool 6 further generates a display of a progress bar visually indicating the percentage progress of the transform application 12a, b...n in transforming the user selected source file in the source file format to the user selected destination file in the destination file format.

#### Additional Implementation Details

[0025] The described transform tool and transform applications may be implemented as a method, apparatus or article of manufacture using standard programming and/or engineering techniques to produce software, firmware, hardware, or any combination thereof. The term "article of manufacture" as used herein refers to code or logic implemented in hardware logic (e.g., an integrated circuit chip, Field Programmable Gate Array (FPGA), Application Specific Integrated Circuit (ASIC), etc.) or a computer readable medium (e.g., magnetic storage medium (e.g., hard disk drives, floppy disks, tape, etc.), optical storage (CD-ROMs, optical disks, etc.), volatile and non-volatile memory devices (e.g., EEPROMs, ROMs, PROMs, RAMs, DRAMs, SRAMs, firmware, programmable logic, etc.). Code in the computer readable medium is accessed and executed by a processor. The code in which preferred embodiments are implemented may further be accessible through a transmission media or from a file server over a

network. In such cases, the article of manufacture in which the code is implemented may comprise a transmission media, such as a network transmission line, wireless transmission media, signals propagating through space, radio waves, infrared signals, etc. Of course, those skilled in the art will recognize that many modifications may be made to this configuration without departing from the scope of the present invention, and that the article of manufacture may comprise any information bearing medium known in the art.

[0026] In the described implementations, the format dial and arrows drawn between the nodes of the dial, as shown in FIG. 4, were used to illustrate the available file transformations. For instance, icons representing the different file formats may be displayed at the file format nodes 52a, b...h. Alternatively, different graphical techniques may be used to illustrate the available file transform operations. For instance, file transform formats may be displayed in columnar format side-by-side and lines drawn between the listed file formats to show available transformations. Alternative display techniques may be used to display the available transformations for multiple file formats.

[0027] In the described implementations, the transform table 8 was used to indicate the available file transforms, where an entry at row  $i$  and column  $j$  is capable of providing a transform application 12a, b...n from file format  $i$  to file format  $j$ . Those skilled in the art will appreciate that alternative data structures may be used to indicate available transformations between file formats and the location of transform applications 12a, b...n to perform such file format transformations. Additionally, the transform table 8 may have dimensions and/or a format different than those described herein, or be implemented in multiple tables or data structures.

[0028] In the described implementations, multiple transform applications 12a, b...n were available to perform the file format transformations. Alternatively, there may be one transform application capable of performing all the available file format transforms.

[0029] The logic of FIGs. 5, 6, and 7 is for illustrative purposes. Additional or alternative steps may be performed in addition to those illustrated in the logic. Further, the order of the steps in the preferred logic may also vary.

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